

Assessment of Air Quality in the International Space Station (ISS) and Space Shuttle Based on Samples Returned aboard STS-108 (UF1) in December 2001

The toxicological assessment of grab sample canisters (GSCs) returned aboard STS-108 is reported. Analytical methods have not changed from earlier reports, and surrogate standard recoveries from the GSCs were 81-119%. Pressure tracking indicated no leaks in the canisters.

The two general criteria used to assess air quality are the total-non-methane-volatile organic hydrocarbons (NMVOCs) and the total T-value (minus the CO₂ and formaldehyde contributions). Because of the inertness of Freon 218 (octafluoropropane, OFP), its contribution to the NMVOC is subtracted and tabulated separately. Control of atmospheric alcohols is important to the water recovery system engineers, hence total alcohols are also shown for each sample. Because formaldehyde is quantified from sorbent badges, its concentration is listed separately. These five indices of air quality are summarized below:

<u>Sample Location</u>	<u>Date/Type</u>	<u>NMVOCs - OFP</u> (mg/m ³)	<u>OFP</u> (mg/m ³)	<u>T Value^a</u> (units)	<u>Alcohols</u> (mg/m ³)	<u>Formaldehyde</u> (mg/m ³)
SM (contingency)	9/1/01	10	632	1.08	5.6	ns ^b
FGB	9/13/01	9	332	0.90	5.5	ns
SM	9/13/01	5	334	0.84	3.9	0.030
Lab	9/13/01	8	334	0.86	4.1	0.037
Lab	10/10/01	7	221	0.43	5.5	0.038
FGB	10/10/01	12	212	0.83	7.3	ns
SM	10/10/01	7	195	0.23	5.5	0.025
SM ^c	11/15/01	15	284	0.82	11.1 ^e	0.027
Lab	11/15/01	ns	ns	ns	ns	0.045
MPLM2	12/09/01	13	20	1.02	6.4	ns
SM	12/09/01	10	295	1.08	7.3	ns
Lab	12/09/01	13	244	1.46	7.9	ns
Lab	12/15/01	9	245	0.64	6.3	ns
Shuttle Preflight ^d	12/5/01	3	0	0.69	0.7	ns
Shuttle Middeck	12/17/01	11	194	0.54	3.9	ns
Acceptable Health Guideline:		<25	85000	<1	<10	0.050

^a Formaldehyde and CO₂ not included in T calculation.

^b ns = not sampled

^c FGB sample was bad and no Lab GSC sample was taken on 11/15/01

^d This sample was unusually contaminated for a preflight sample. This may be due to interruption of airflow to the vehicle's environmental system for several hours before the sample was acquired. There is no health concern.

^e Due to an unusually high ethanol of 9.9 mg/m³

The table shows that the air quality in general was acceptable for crew respiration. There is a trend of decreasing concentrations of OFP. The only T value significantly above 1 was from the Lab on 12/9/01. For health assessment, this value can be divided into toxicological groups with associated T-Values as follows: irritants (0.63), neurotoxins (0.33), reproductive toxins (0.20), hepatotoxins (0.04), cardiotoxins (0.17), and respiratory system toxins (0.28). Formaldehyde at times approaches its limit and there is a pattern of slightly higher levels in the Lab compared to the SM. This could be due to differences in air scrubbing and humidity condensing capacity in the modules or to more sources of formaldehyde in the Lab.

Enclosures

1A: [Analytical Results of UF1 GSC Samples](#)

1B: [T Values of UF1 GSC Samples](#)

2A: [Analytical Results of STS-108 GSC Samples](#)

2B: [T Values of STS-108 GSC Samples](#)

